Carpet Solutions: Polyester/Cationic Dyeable Polyester

Dyeing and printing of carpets requires specific solutions.

Make your carpet colorful!
## Polyester fibers used in carpets

### Aromatic Polyester fibers

<table>
<thead>
<tr>
<th>CRYSTAL STRUCTURE</th>
<th>PROPERTIES</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>PET</strong></td>
<td><strong>MP (°C)</strong> 265</td>
</tr>
<tr>
<td><strong>PTT</strong></td>
<td><strong>Tg (°C)</strong> 70-80</td>
</tr>
<tr>
<td><strong>PBT</strong></td>
<td><strong>Settable</strong> yes</td>
</tr>
<tr>
<td><strong>Elasticity</strong></td>
<td><strong>Dyeing temperature (°C)</strong></td>
</tr>
<tr>
<td></td>
<td><strong>PET</strong></td>
</tr>
<tr>
<td><strong>Elasticity</strong></td>
<td>*</td>
</tr>
<tr>
<td><strong>Dyeing temperature (°C)</strong></td>
<td>130/135</td>
</tr>
</tbody>
</table>

### Properties of Polytrimethylene Terephthalate (PTT)

- **PTT** is based on terephthalic acid and propanediol
- Due to the intermediates used, **PTT** has a more open structure compared to **PET**
  - Dyeable at 110 °C
  - Excellent color build-up at 110 °C
- Compatibility with sensitive fibers, e.g. wool
- Good to excellent color fastness
- Time and energy savings in dyeing and printing
- Much better resilience of the pile compared to **PET**
Dyeability of different Polyester fibers

**Polyester**

- **PET**
  - TPA + Ethanediol (n=2)
  - Polyethylene terephthalate
  - Washing control slightly lower
  - Light control slightly lower
  - Steaming before and after washing
  - Short high
  - Long low
  - Recycled PET
  - TPA + Ethanediol (n=2)
  - Polyethylene terephthalate
  - V-Value
  - Before and after washing
  - Low
  - High

**COLOR FASTNESS**

<table>
<thead>
<tr>
<th>Washing</th>
<th>PET</th>
<th>PTT</th>
<th>Recycled PET</th>
</tr>
</thead>
<tbody>
<tr>
<td>Control</td>
<td>Slightly lower</td>
<td>Slightly lower</td>
<td>Lower</td>
</tr>
<tr>
<td>Control</td>
<td>Slightly lower</td>
<td>Lower</td>
<td>Lower</td>
</tr>
</tbody>
</table>

DyStar
Carpet Solutions: Polyester

Important data for disperse dye selection

Fiber

➤ Each kind of PES fiber has a different dyeing rate indicated by the V-value

Steaming conditions

➤ Depending on V-value of the polyester fiber

The lower the V-value:
➤ The longer the steaming time
➤ The more diffusion accelerator is needed

➤ Depending on dyestuff

The bigger the molecule structure:
➤ The longer the steaming time
➤ The more diffusion accelerator is needed

Determination of the polyester fiber dyeing rate (V-value)

<table>
<thead>
<tr>
<th>Dyeing:</th>
<th>V Scale</th>
<th>Exhaust:</th>
</tr>
</thead>
<tbody>
<tr>
<td>0.33% Dianix® Red SE-3B</td>
<td>0.25</td>
<td>Visual Determination V = 0.25 - 8</td>
</tr>
<tr>
<td>1 g/l Sera Gal P-LP, pH 4.5, LR 40:1</td>
<td>0.5</td>
<td>Visual Determination V-value 4</td>
</tr>
<tr>
<td>20 min at 105 °C (heating rate: as rapid as possible)</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td></td>
<td>2</td>
<td></td>
</tr>
<tr>
<td></td>
<td>4</td>
<td></td>
</tr>
<tr>
<td></td>
<td>8</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Remaining liquor with new sample</td>
</tr>
<tr>
<td></td>
<td></td>
<td>60 min at 130 °C</td>
</tr>
</tbody>
</table>

Example:

Typical V-values:
➤ Standard polyester = 0.5 – 1.0
➤ Deep dyeing = 1.0 – 2.0
➤ Carrier free = 2.0 – 4.0
➤ PTT = 2.0 – 4.0 – 8.0
Dianix® dye selection for:

Dyeing at low temperature and on polyester fibers with low V-value as well as for printing

**Dianix AC-E dyes**

- Compatible, level-dyeing dyes for rapid and reliable dyeing
- Outstanding Right-First-Time performance through compatibility of dyes and state-of-the-art accuracy in standardizing
- Low energy dyes

- Dianix Yellow AC-E new
- Dianix Red AC-E 01
- Dianix Blue AC-E

**Dianix E dyes**

- Popular, well-established dyes
- Low energy dyes

- Dianix Yellow E-3G
- Dianix Red E-FB
- Dianix Blue E-R 150%

**Additonal Dianix dyes**

- Higher energy dyes with good exhaustion at low dyeing temperature

- Dianix Blue AM-77 150%
- Dianix Turquoise S-BG
## Dyeing under HT conditions and for printing

### Dianix K dyes
- Compatible, level-dyeing dyes for rapid and reliable dyeing
- Excellent on-tone build-up with critical shades and fibers
- Good light fastness and wet fastness properties

<table>
<thead>
<tr>
<th>Dianix Orange K-3G</th>
<th>Dianix Blue K-FBL</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dianix Red K-2B</td>
<td>Dianix Black K-B</td>
</tr>
</tbody>
</table>

### Dianix CC dyes
- Compatible, level-dyeing dyes for rapid and reliable dyeing
- Good wet fastness properties
- In most cases a diffusion accelerator is needed in printing application

<table>
<thead>
<tr>
<th>Dianix Yellow CC</th>
<th>Dianix Red CC</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dianix Yellow Brown CC</td>
<td>Dianix Blue CC</td>
</tr>
</tbody>
</table>

### Dianix S dyes
- Popular, well established high energy dyes
- Good wet fastness properties
- In most cases a diffusion accelerator is needed in printing application

<table>
<thead>
<tr>
<th>Dianix Yellow S-3G</th>
<th>Dianix Blue S-2G</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dianix Rubine S-2G 150%</td>
<td>Dianix Turquoise S-BG</td>
</tr>
</tbody>
</table>
Dianix® dye selection for:

Dyeing under HT conditions and for printing

**Dianix AM/HLA dyes**
- Dye range with outstanding levels of light fastness
- In most cases a diffusion accelerator is needed in printing application

<table>
<thead>
<tr>
<th>MAIN SELECTION</th>
<th>ADDITIONAL DYES</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dianix Yellow AM-G</td>
<td>Dianix Yellow AM-42</td>
</tr>
<tr>
<td>Dianix Red AM-B</td>
<td>Dianix Red AM-86</td>
</tr>
<tr>
<td>Dianix Blue AM-R</td>
<td>Dianix Blue AM-77 150%</td>
</tr>
<tr>
<td>Dianix Black HLA-E</td>
<td></td>
</tr>
</tbody>
</table>

**Dianix Micro Liquid dyes**
- High-energy liquid dye range for printing
- Standardized in continuous dyeing and printing
- Suitable for digital printing with higher nozzle fineness, e.g. 76 dpi

<p>| | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Dianix Yellow 3G liq</td>
<td>Dianix Blue BG liq</td>
</tr>
<tr>
<td>Dianix Red BEL liq</td>
<td>Dianix Black HSL liq 90%</td>
</tr>
</tbody>
</table>
Cationic Dyeable Polyester fibers used in carpets

Cationic Dyeable Polyester fibers

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<thead>
<tr>
<th>CRYSTAL STRUCTURE</th>
<th>PROPERTIES</th>
</tr>
</thead>
<tbody>
<tr>
<td><img src="image" alt="Crystal Structure" /></td>
<td><strong>MP (°C)</strong>: 265°C</td>
</tr>
<tr>
<td></td>
<td><strong>Tg (°C)</strong>: 60-70</td>
</tr>
<tr>
<td></td>
<td><strong>Settable</strong>: yes</td>
</tr>
<tr>
<td></td>
<td><strong>Elasticity</strong>: low</td>
</tr>
<tr>
<td></td>
<td><strong>Dyeing temperature (°C)</strong>: 100 to 120</td>
</tr>
</tbody>
</table>
Properties of Cationic Dyeable Polyester fibers (CDP)

➤ CDP is an anionic modified polyester fiber that forms a salt bondage with cationic dyes like Astrazon® dyes

➤ Due to the modification of the fiber with anionic groups the polymer structure is more open, so that the affinity for disperse dyes is higher than to regular polyester fibers

➤ Dependent on the fiber fineness cationic dyes show very good or limited light fastness
  ➢ Light fastness on a 3.3 dtex CDP fiber = 6-7
  ➢ Light fastness on a 1 dtex CDP fiber = 4-5

➤ Reduced light fastness of cationic dyes on CDP is related to the missing ability of quenching excitation energy

➤ Most brilliant shades possible

➤ Soft handle of the carpet

➤ Multicolor effects in blends with PET

➤ Excellent wet fastness and color blocking effect
**Astrazon® dye selection for:**

**Dyeing and printing of Cationic Dyeable Polyester fibers (CDP)**

<table>
<thead>
<tr>
<th>Dye Name</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Astrazon Yellow 8GSL 200%*</td>
<td>Clear greenish yellow, specialty dye with highest LF</td>
</tr>
<tr>
<td>Astrazon Yellow 7GLL 200%</td>
<td>Clear greenish yellow with high lightfastness</td>
</tr>
<tr>
<td>Astrazon Golden Yellow GL-E 200%</td>
<td>Economical golden yellow for standard combination</td>
</tr>
<tr>
<td>Astrazon Red GTLN micro 200%</td>
<td>Economical yellowish red for standard combination with highest steam-, pH and dyebath stability</td>
</tr>
<tr>
<td>Astrazon Red GL-N 300%*</td>
<td>Neutral red, specialty dye with highest LF in the market</td>
</tr>
<tr>
<td>Astrazon Red FBL 200%</td>
<td>Clear bluish red for use in standard combination</td>
</tr>
<tr>
<td>Astrazon Blue F2RL 200%</td>
<td>Clearest blue, specialty dye with highest steam-, pH- and dyebath stability</td>
</tr>
<tr>
<td>Astrazon Blue FGRL micro 200%*</td>
<td>Clear blue component for standard combinations, good steam-pH- and dyebath stability</td>
</tr>
<tr>
<td>Astrazon Blue FGGL 300%</td>
<td>Greenish blue for standard combinations</td>
</tr>
<tr>
<td>Astrazon Blue BG micro 200%</td>
<td>Clear blue component, limited steam-, pH- and dyebath stability, suitable only for deep shades</td>
</tr>
<tr>
<td>Astrazon Black FDL 200%</td>
<td>Basic Green 4 free black, good steam-, pH-, dyebath stability</td>
</tr>
</tbody>
</table>

* Dye combination for the highest LF
Trichromatic dyes, as self-shade and in combination, including auxiliaries and process parameter

- **Astrazon Golden Yellow GL-E 200%**
  - 0.5 g/l

- **Astrazon Red FBL 200%**
  - 0.5 g/l

- **Astrazon Blue FGRL micro 200%**
  - 0.5 g/l

- **Sera Sperse M – IW pH 5**
  - 2 g/l

- **Sera Wet C-NR Steaming time 10 min**
  - 2 g/l

- **Sera-Gal P-EW**
  - 10 g/l

- **Astrazon Yellow 8GSL 200%**
  - 0.32 g/l

- **Astrazon Red FBL 200%**
  - 0.02 g/l

- **Astrazon Blue FGRL micro 200%**
  - 0.2 g/l

- **Sera Sperse M – IW pH 5**
  - 2 g/l

- **Sera Wet C-NR Steaming time 10 min**
  - 2 g/l

- **Sera-Gal P-EW**
  - 10 g/l

- **Astrazon Golden Yellow GL-E 200%**
  - 0.06 g/l

- **Astrazon Red FBL 200%**
  - 0.04 g/l

- **Astrazon Blue FGRL micro 200%**
  - 0.07 g/l

- **Sera Sperse M – IW pH 5**
  - 2 g/l

- **Sera Wet C-NR Steaming time 10 min**
  - 2 g/l

- **Sera-Gal P-EW**
  - 4 g/l

- **Astrazon Yellow 8GSL 200%**
  - 0.2 g/l

- **Astrazon Red FBL 200%**
  - 0.2 g/l

- **Astrazon Blue FGRL micro 200%**
  - 0.14 g/l

- **Sera Sperse M – IW pH 5**
  - 2 g/l

- **Sera Wet C-NR Steaming time 10 min**
  - 2 g/l

- **Sera-Gal P-EW**
  - 6 g/l
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